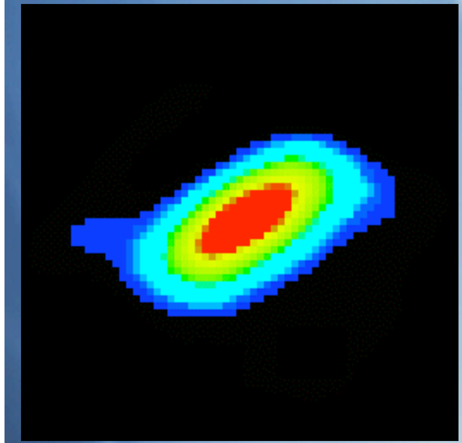
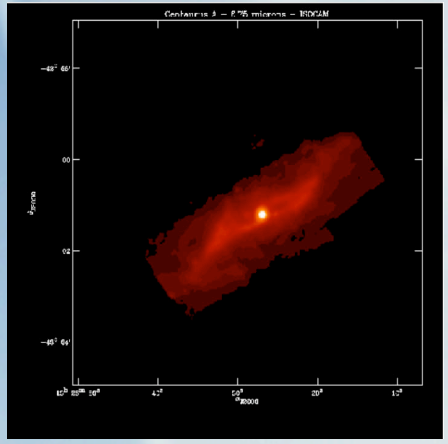
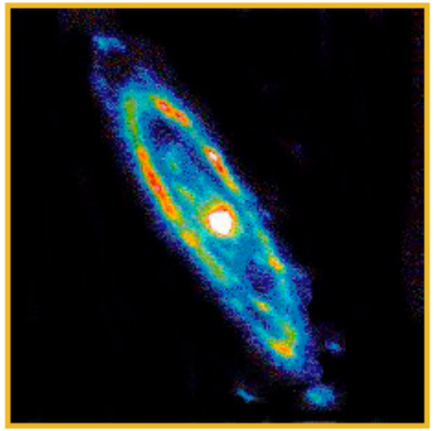
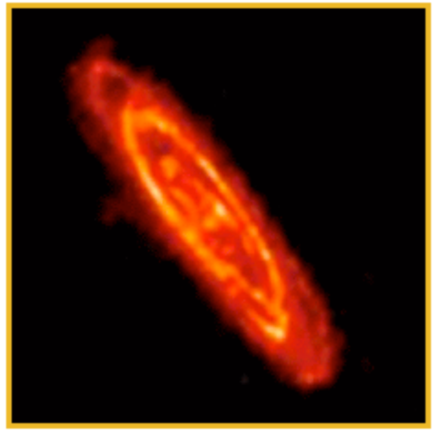
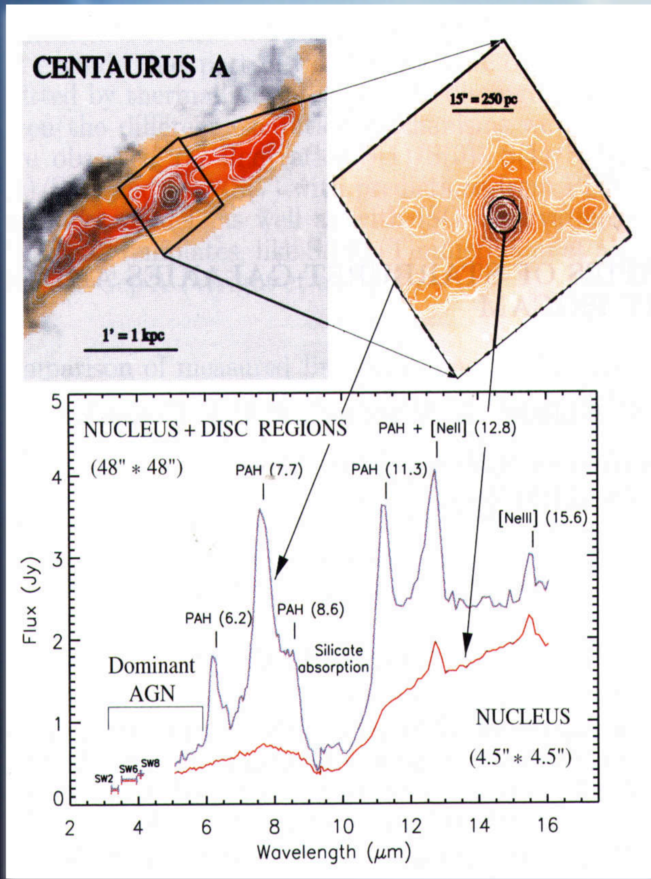






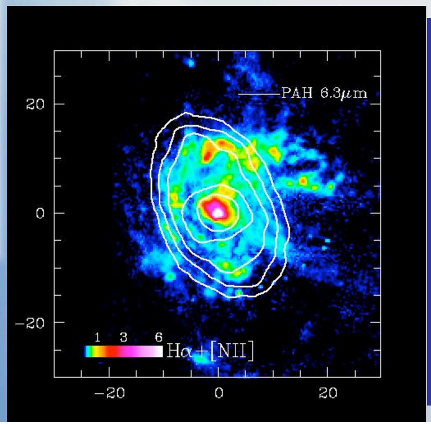


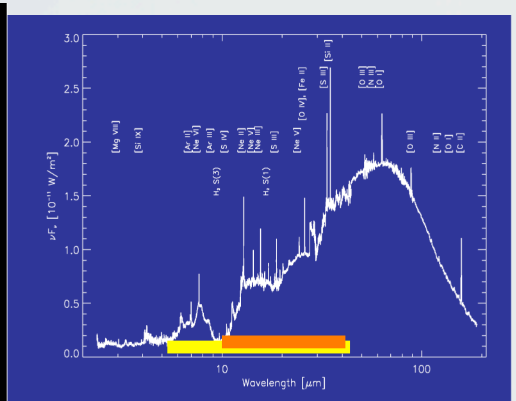


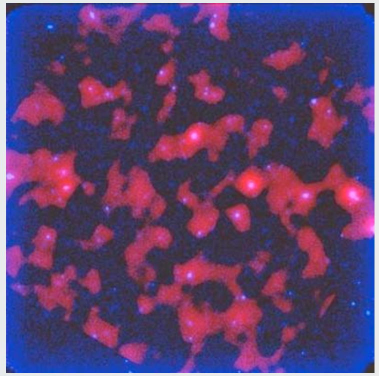
Active Galaxies

QSOs, AGN, starbursts & ULIRGs as seen by ISO

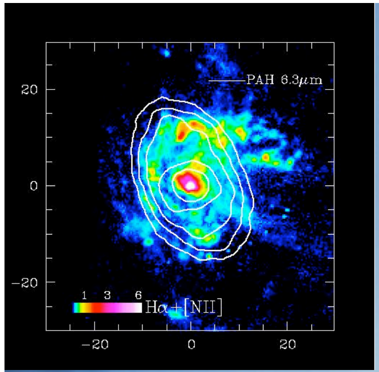
Aprajita Verma
MPE/University of Oxford

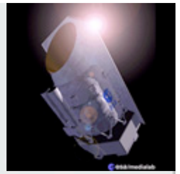






Shaping the SEDs of active galaxies





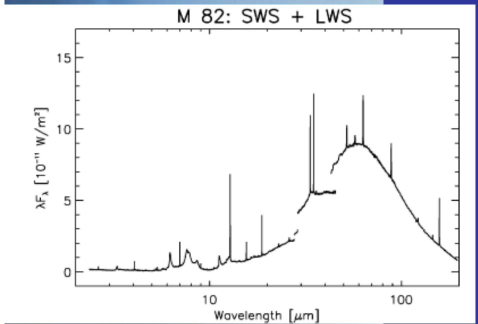
H_2 rotational lines

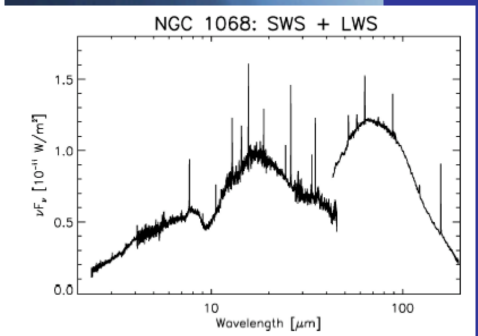
H-recombination lines

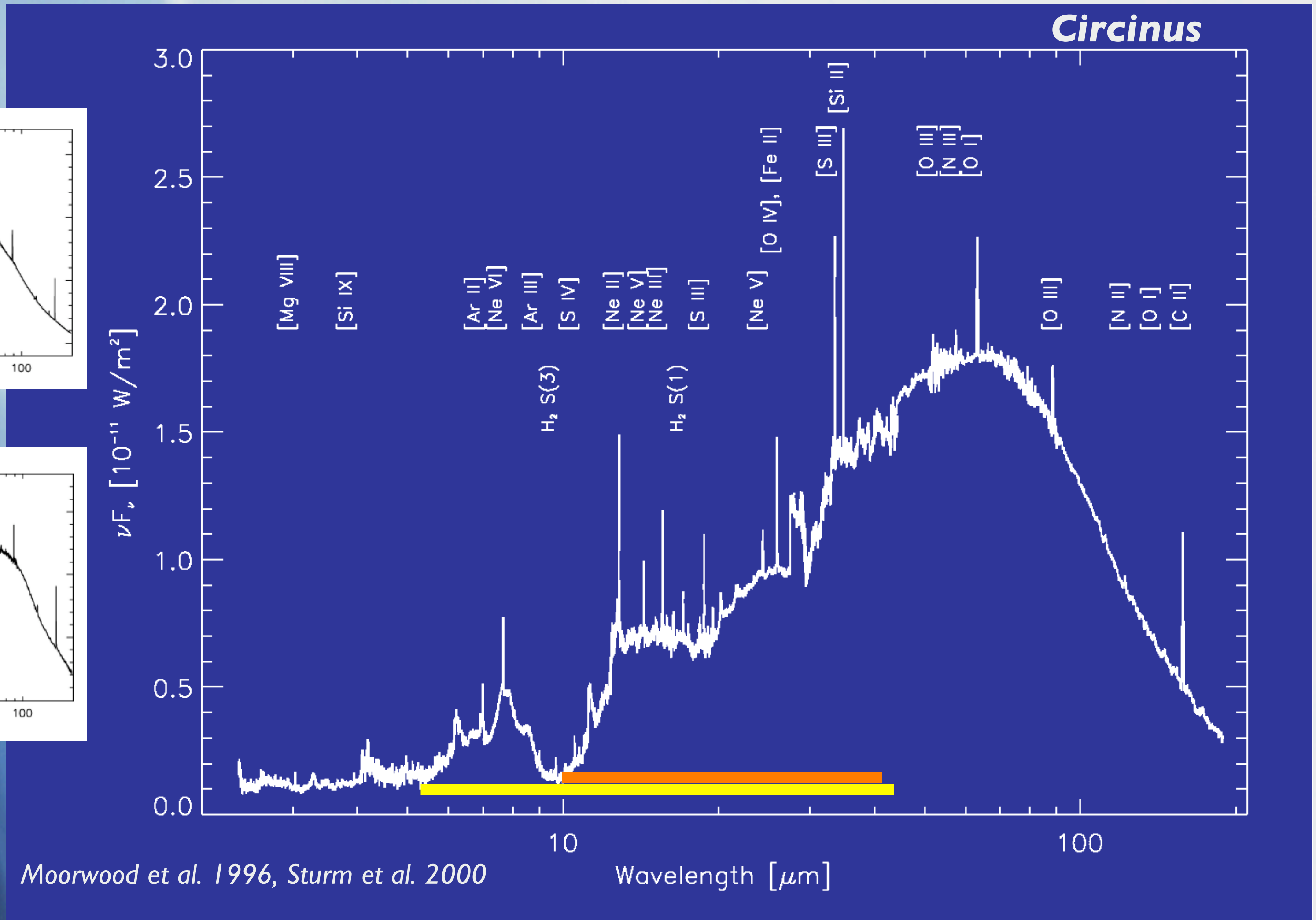
AGN torus

Dust SF regions

Disk/cirrus like dust







FSL

Starlight <5um

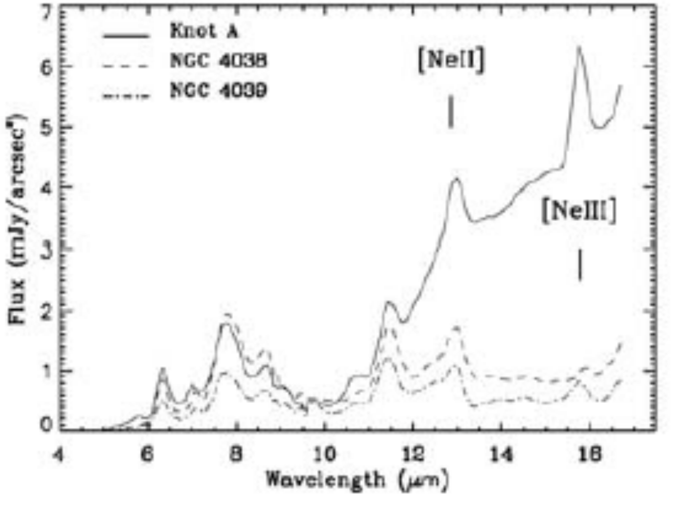
PAHs

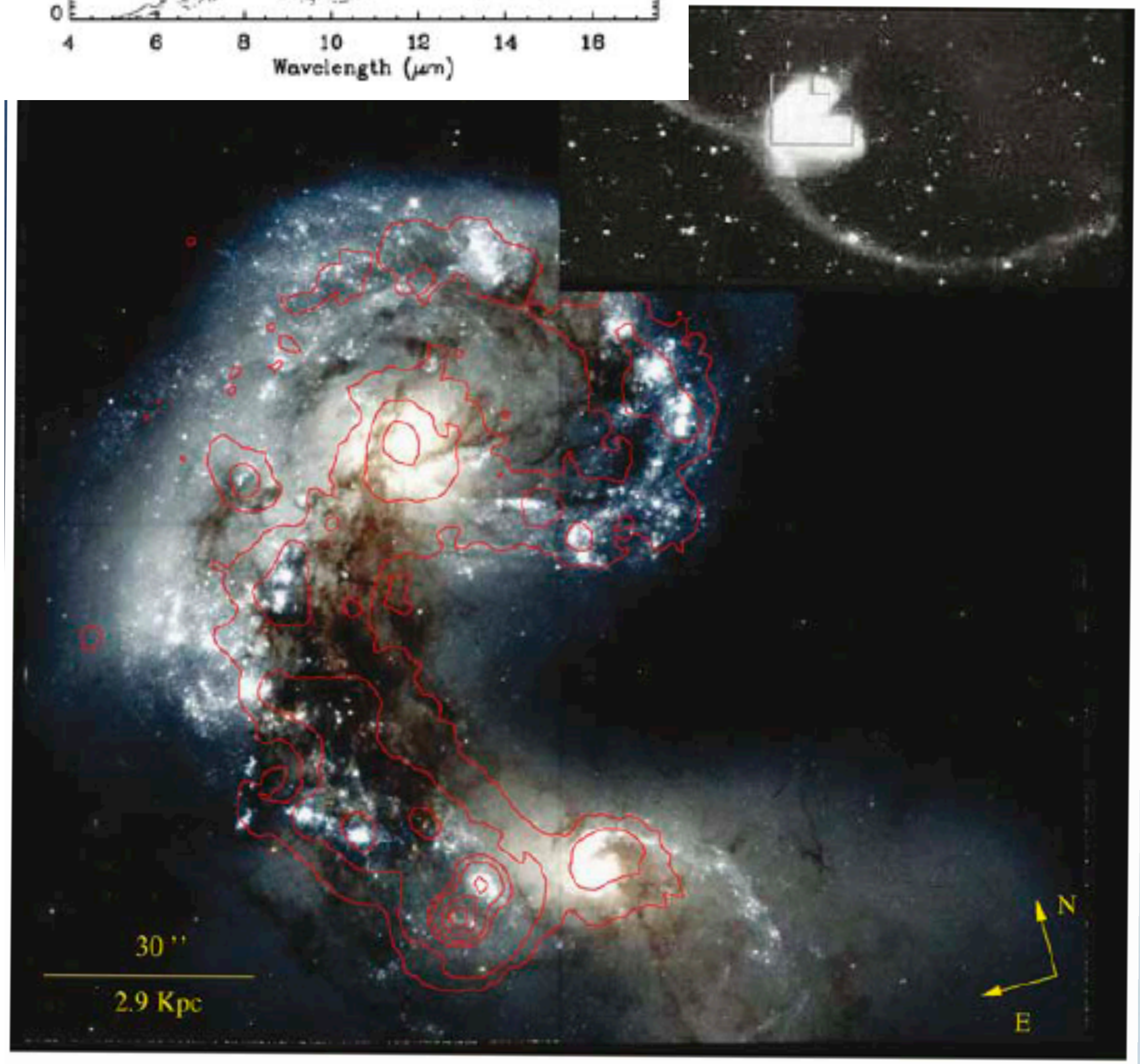
VSG continuum >11um

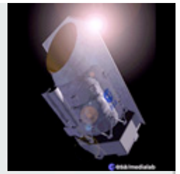
FIR cooling lines

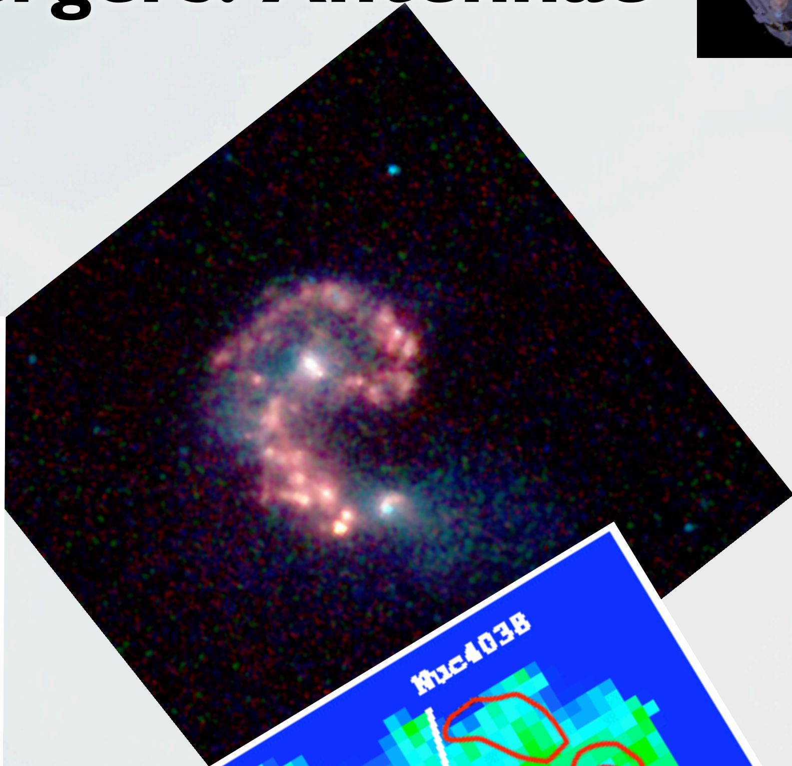
Composite sources

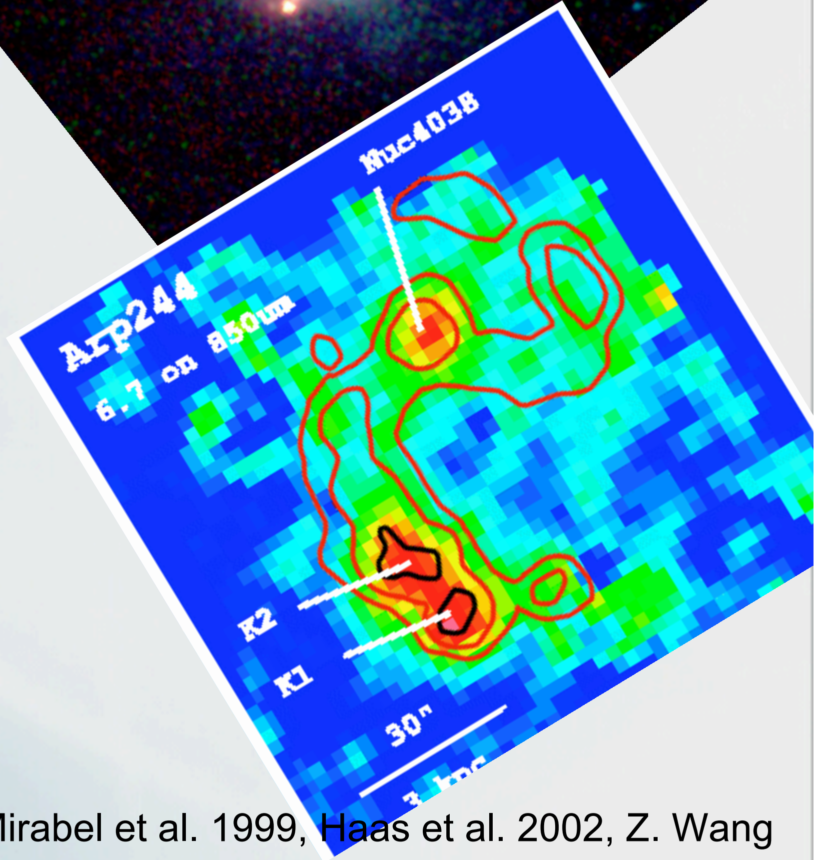
Mergers: Antennae



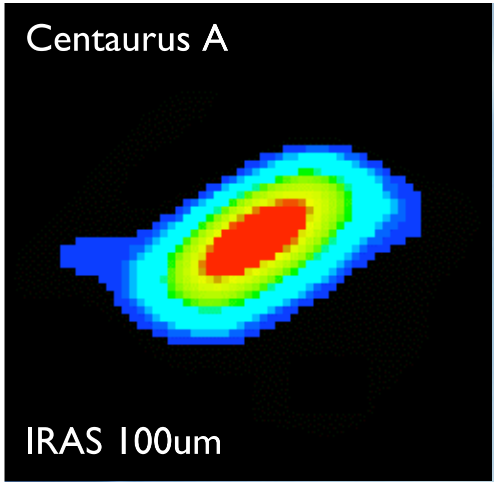


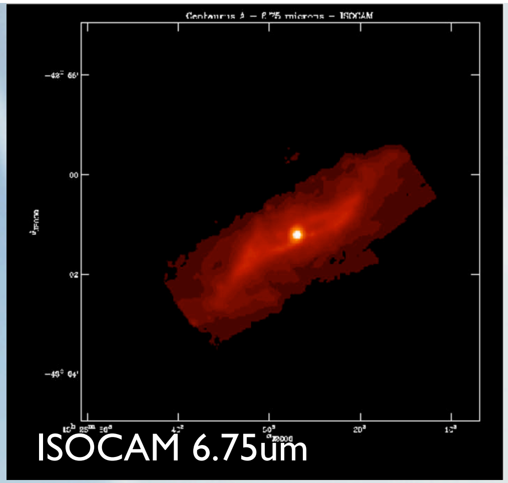


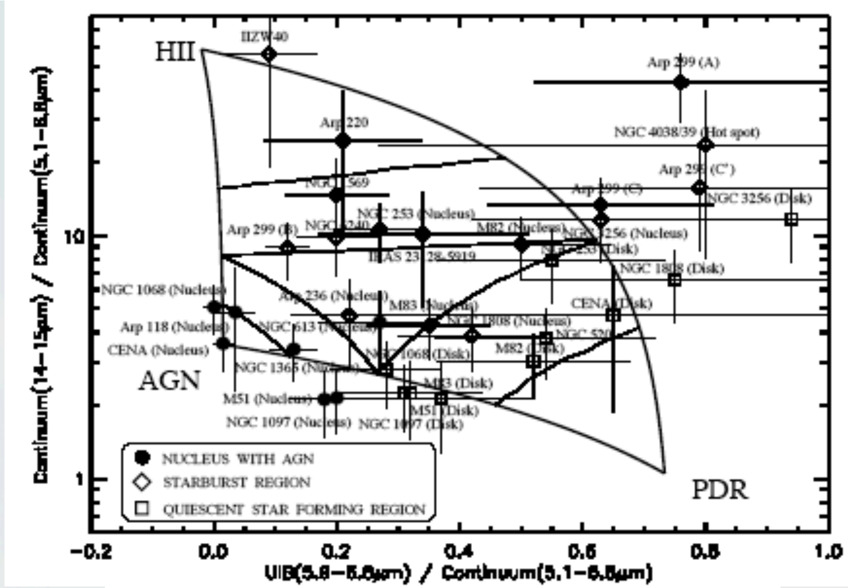


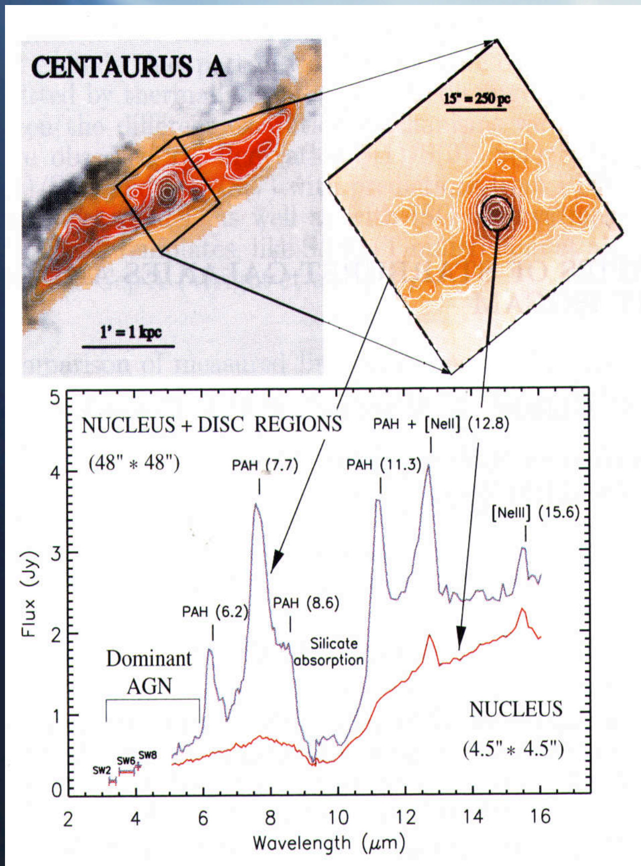


Mirabel et al. 1999, Haas et al. 2002, Z. Wang





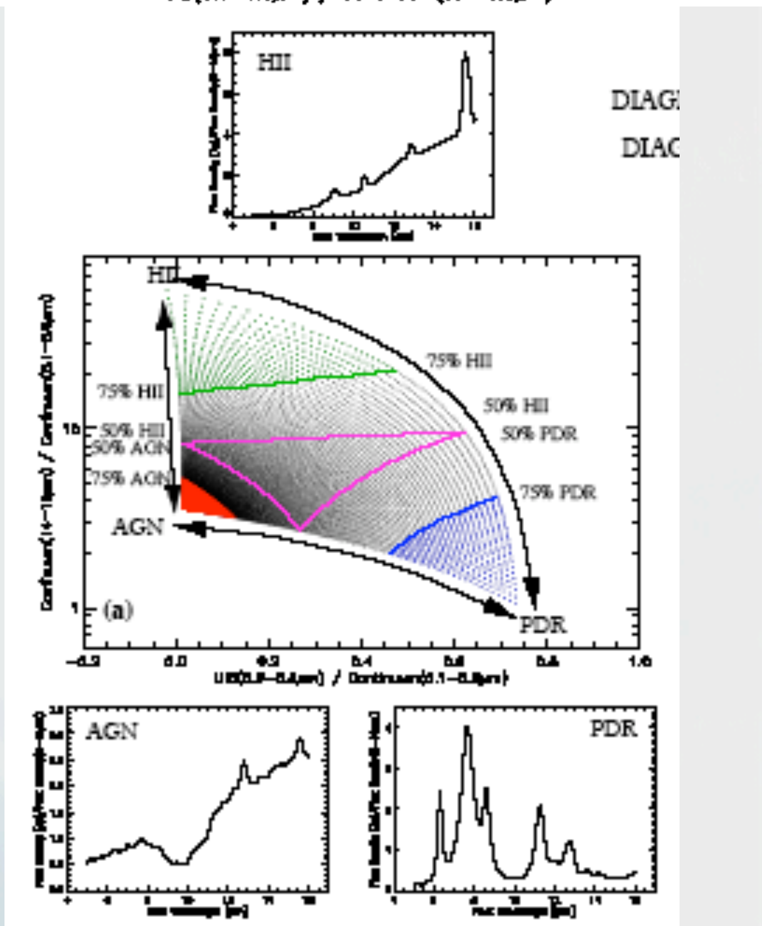




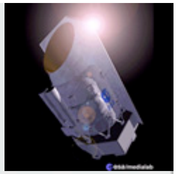
Steep VSG continuum

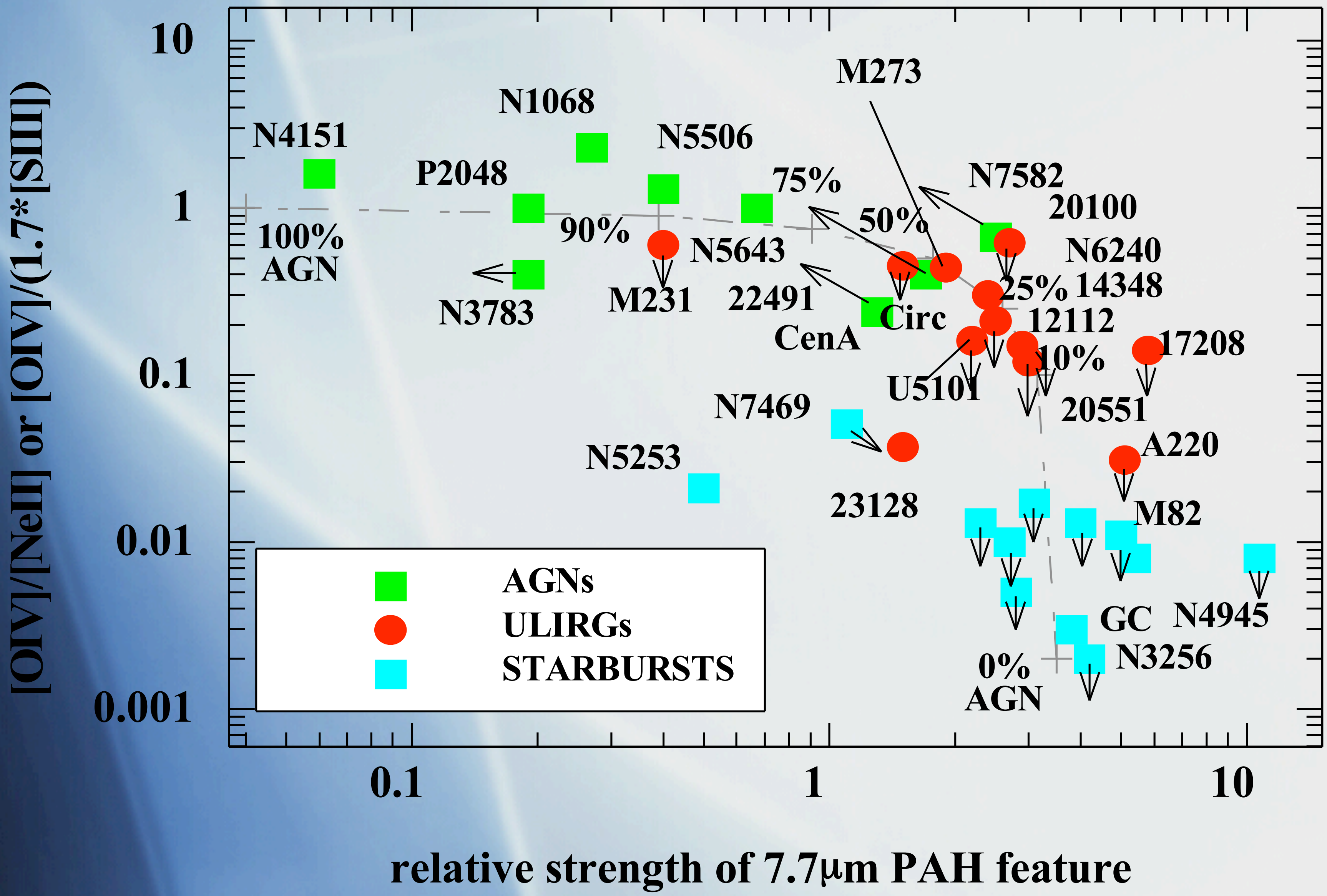
PAH features

AGN continuum



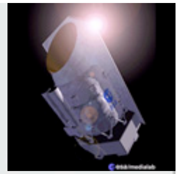
PAH-FSL diagnostics

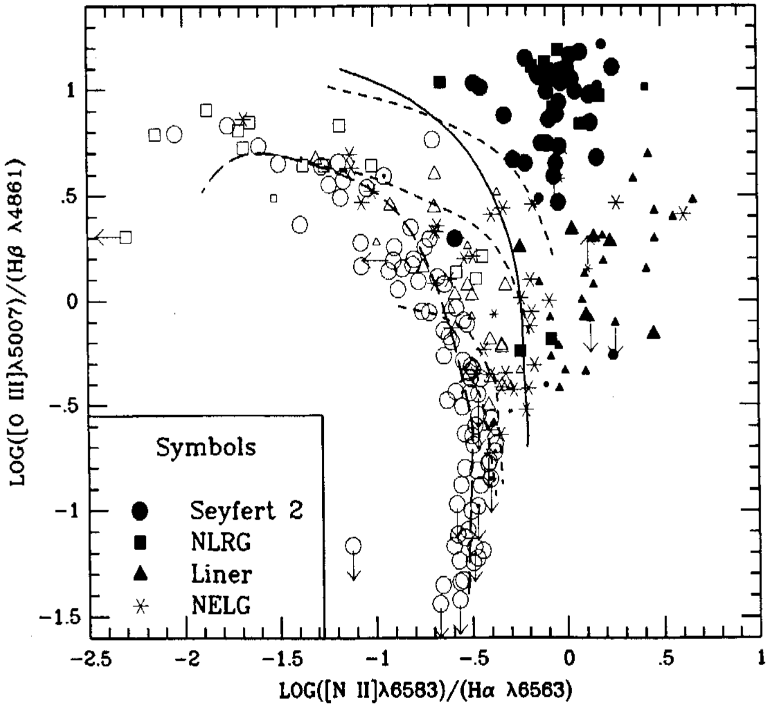




Genzel et al. 1998

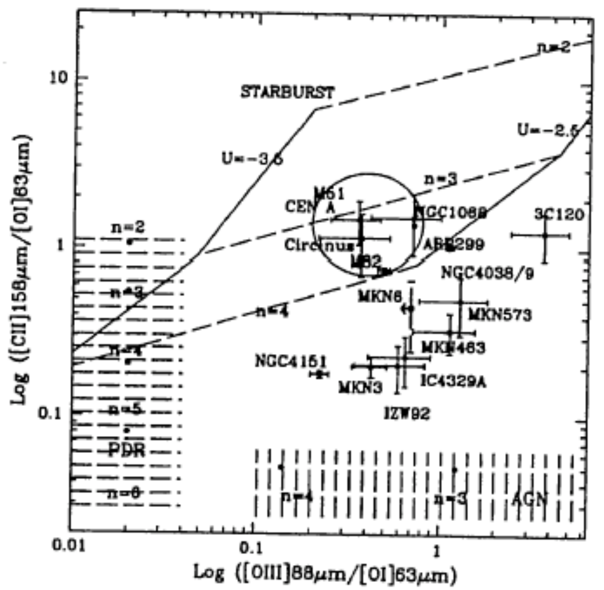
FSL Diagnostics

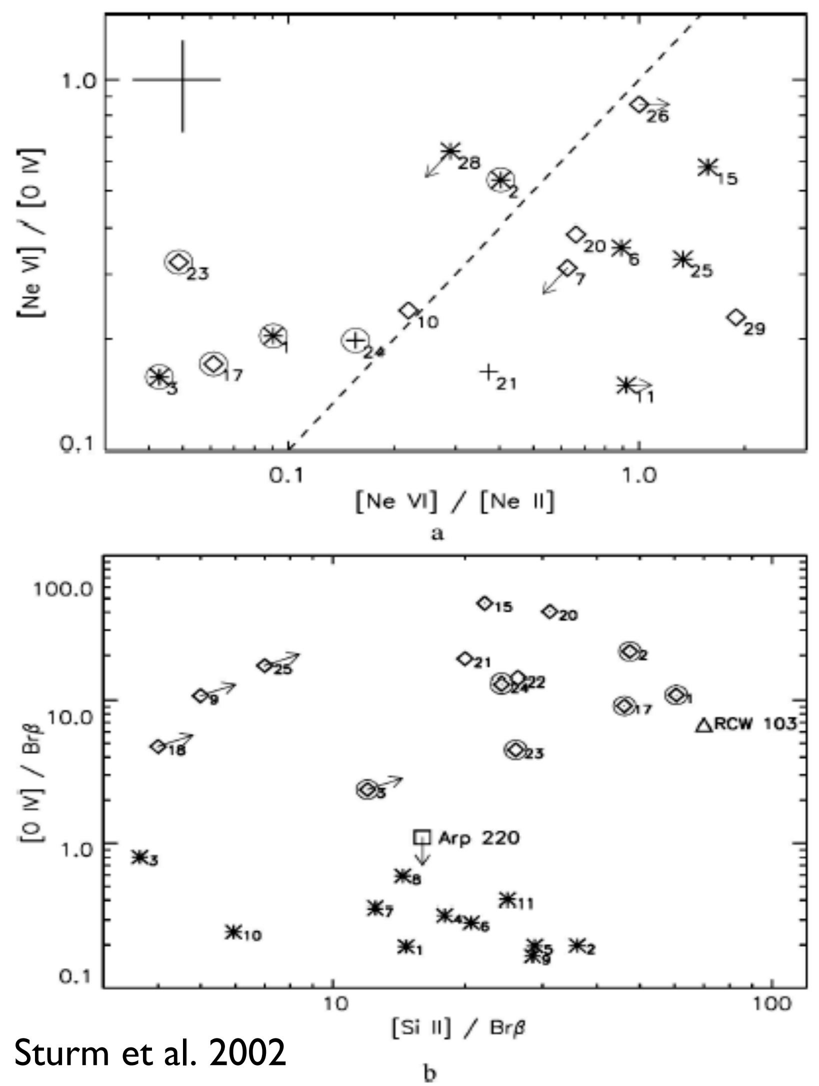




Veilleux & Osterbrock 1987
HII vs. AGN

Spinoglio et al. 2005

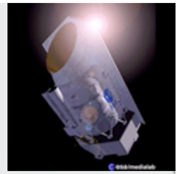




Sturm et al. 2002

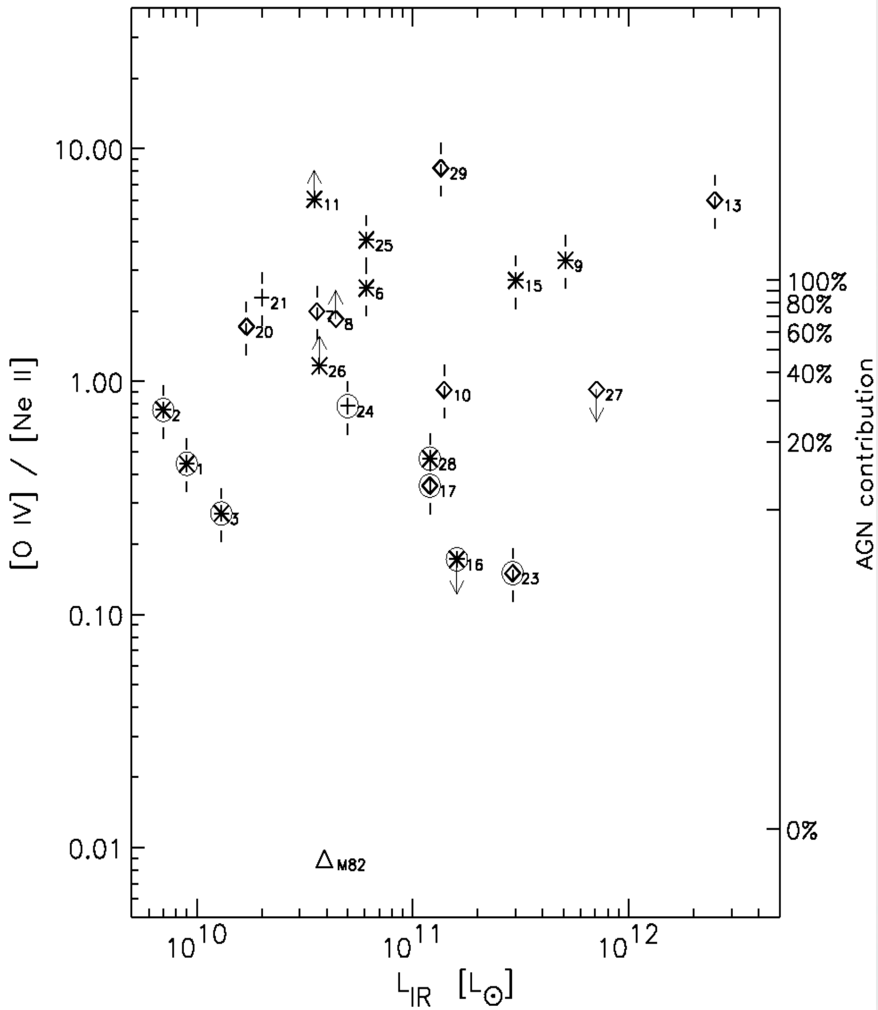
Sy1: diamonds
Sy2: asterisks
Sy+PAH: circle

AGN: diamonds
Stbt: asterisks
PAH: circle



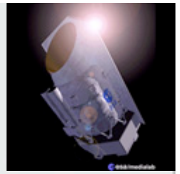
- [OIV]: AGN Narrow Line Region
- [NeII]: Star formation or AGN NLR

- Simple mixing model to assign fractional contributions
- [OIV]/[NeII] always <0.01 in starbursts and
- 0.1 < AGN < 1.0

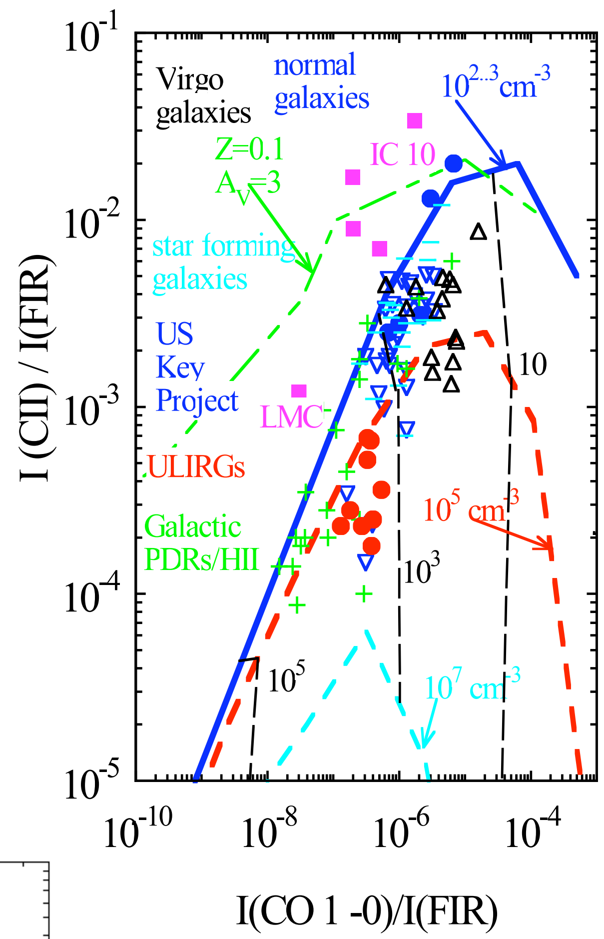


Sturm et al. 2002

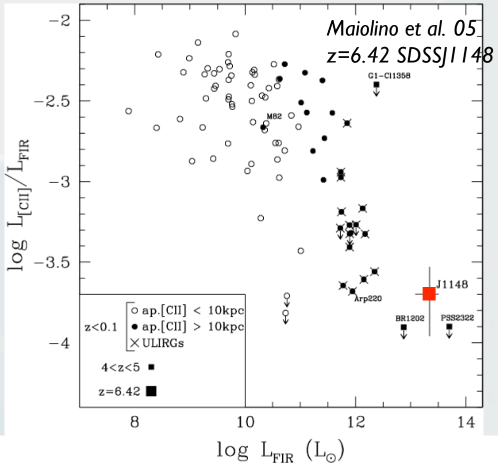
FIR Cooling lines and the CII deficit

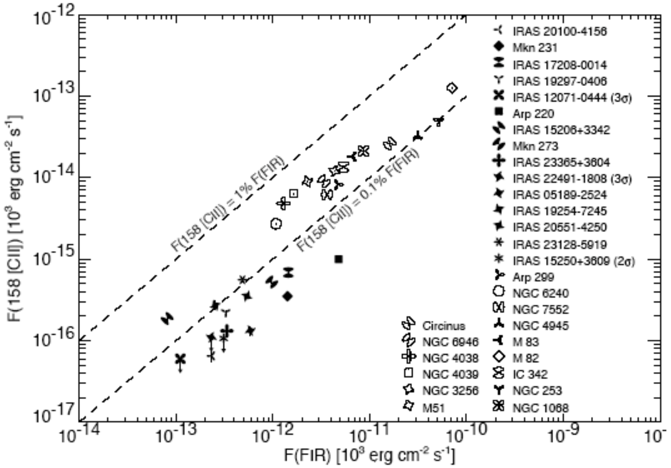


- [CII]158um, [OI]52,88um, [NII]122um,[NIII]57um are important cooling lines in SF regions
- Correlate with the dust continuum over 4 orders of magnitude in the Galaxy (Baluteau et al. 03)
- Scales with PAH and CO relative strength - origin in PDRs, low density gas may also contribute
- Starburst (0.1-1% L_{FIR}), (higher in low metallicity systems, (e.g.,Malhotra et al. 97;Madden 00,Bergvall et al. 00).
- ULIRGs 0.01-0.1% (even lower in LINERs (Sanei et al. 02)
- In 4/5 ULIRGs reduced to (0.01-0.1%)
- Enhancement of FIR relative to CII, non-PDR FIR emission - dust bounded photo-ioniastion regions (Luhman et al. 03)
- Reduced photoelectric heating effieicny
- CII absorption

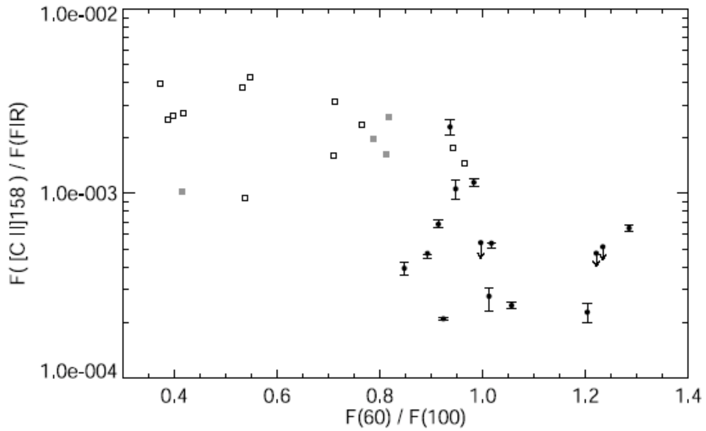


Genzel & Cesarsky 00

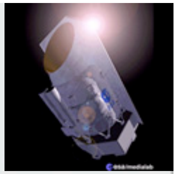


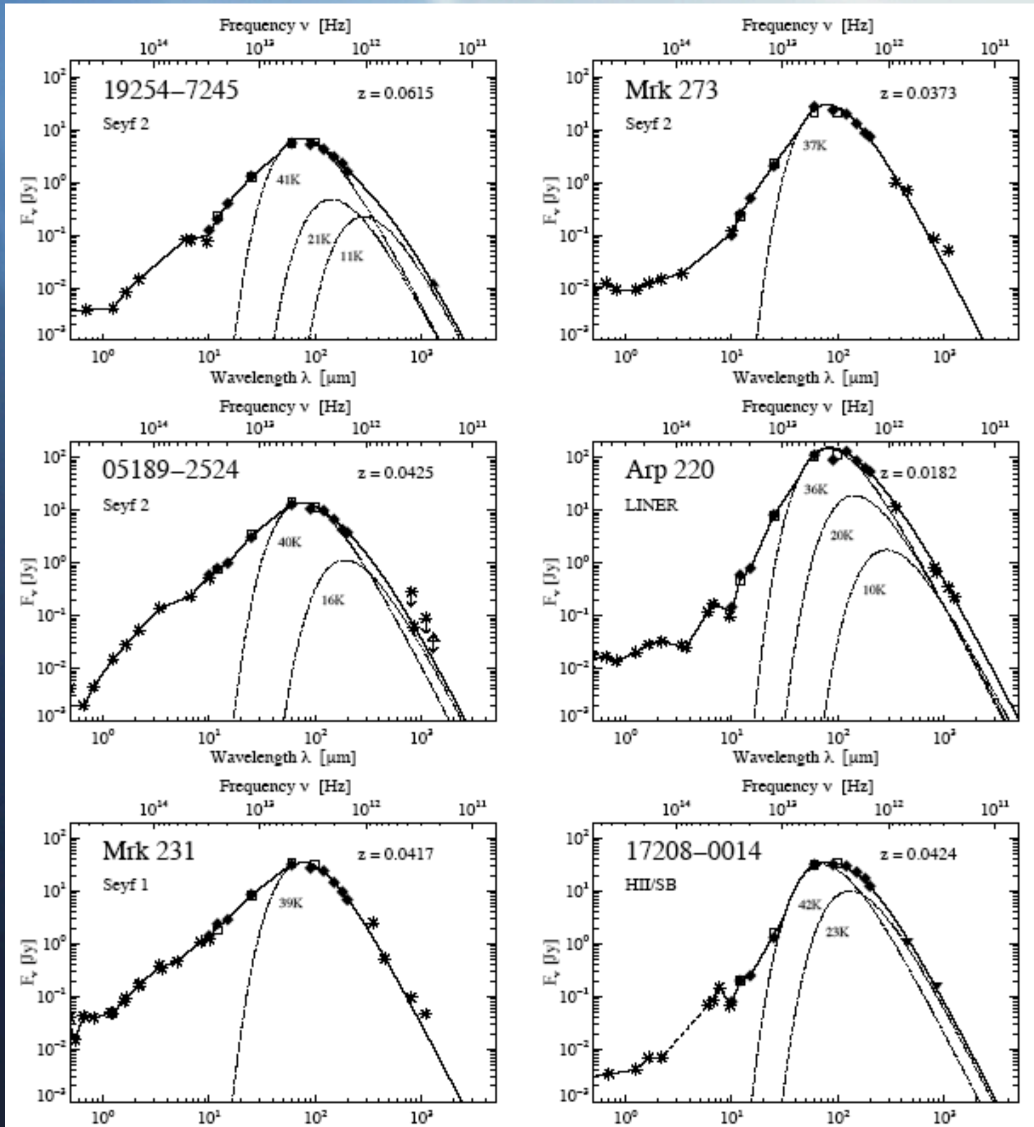


Luhamn et al. 00

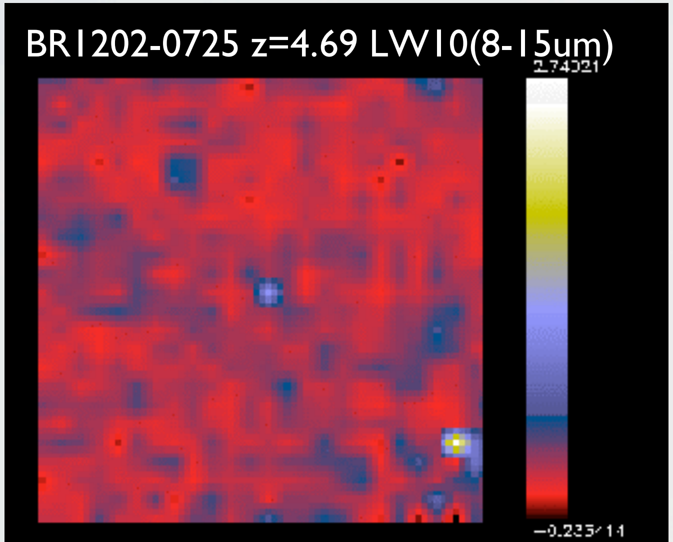


ULIRGS & HLIRGS

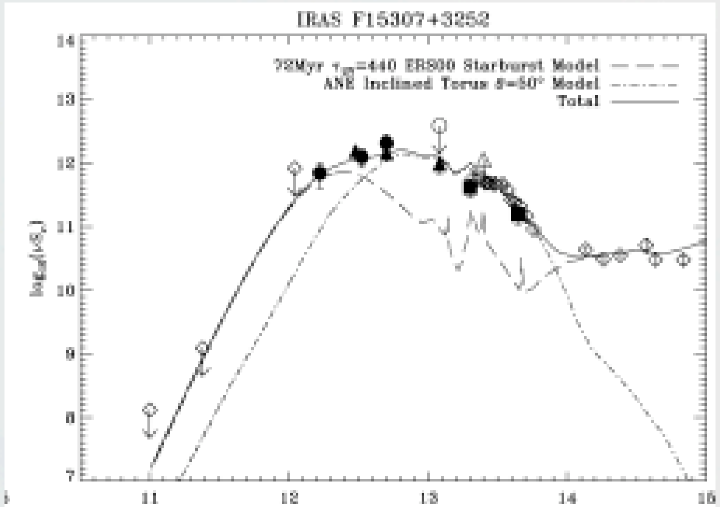




Klaas et al. 2001



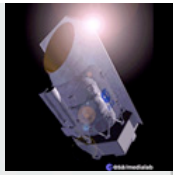
Leech et al. 2001

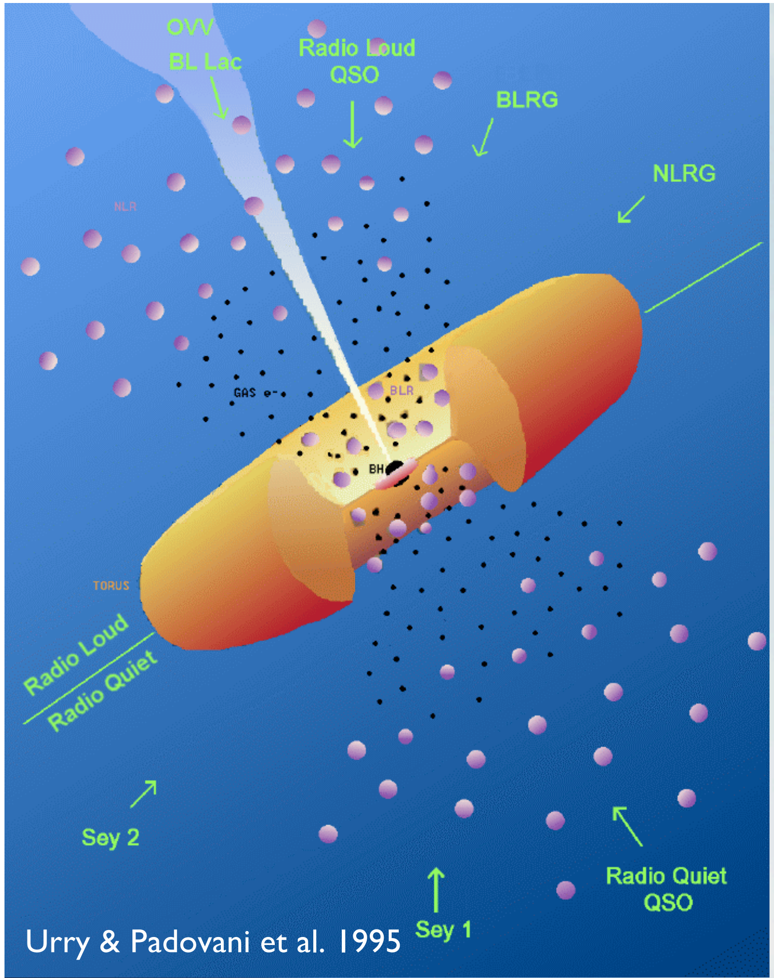


Verma et al. 2003

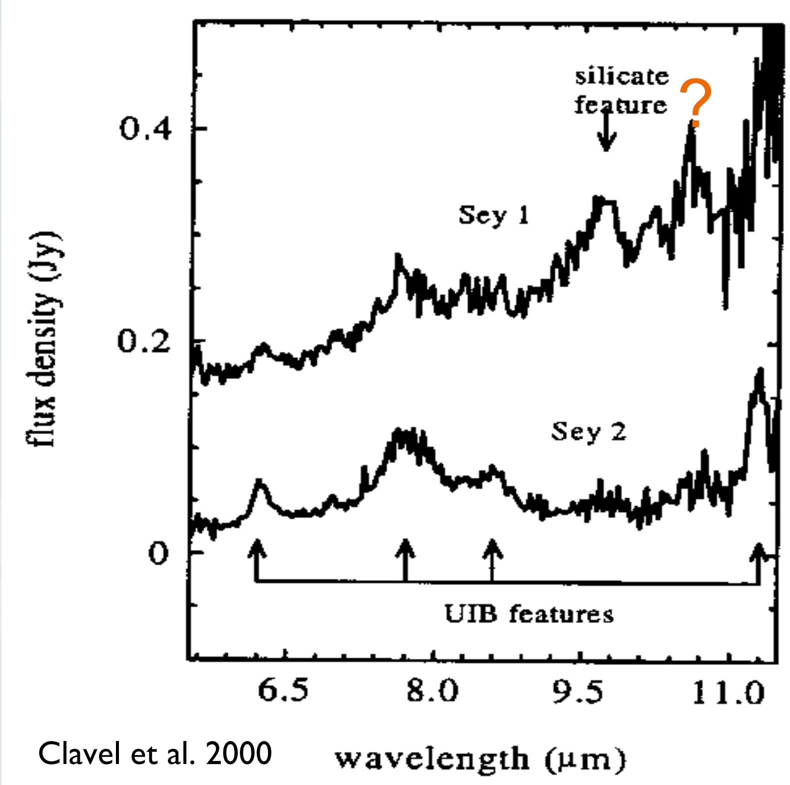
Transition AGN dominated L~$10^{12.4\text{-}12.5}$ $L_\odot$ Tran et al. 2001

Quasar Unification

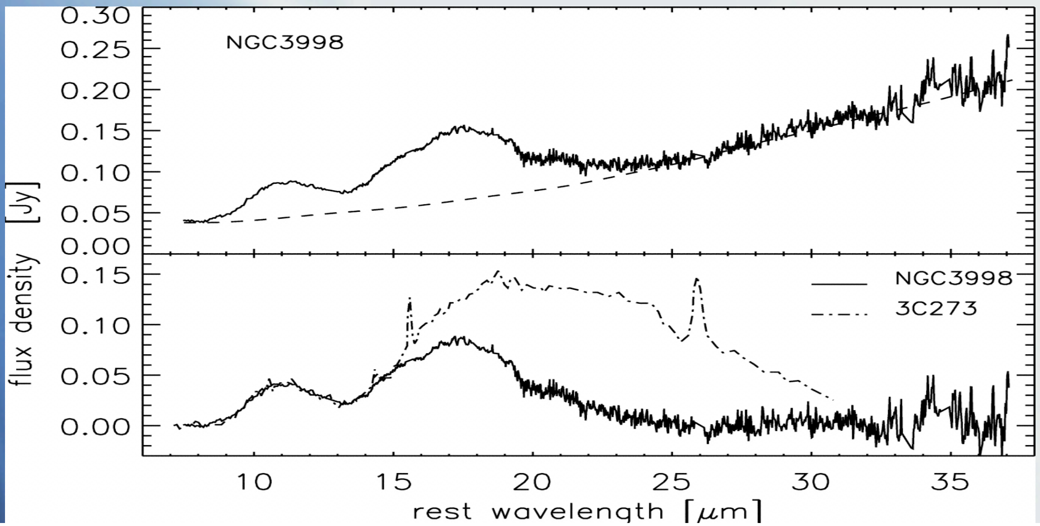




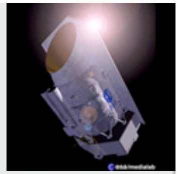
Urry & Padovani et al. 1995



Clavel et al. 2000



Seen in luminous QSOs
Siebenmorgen et al. 2005,
Hao et al. 2005
But also in less luminous
LINERS
Sturm et al. 2005



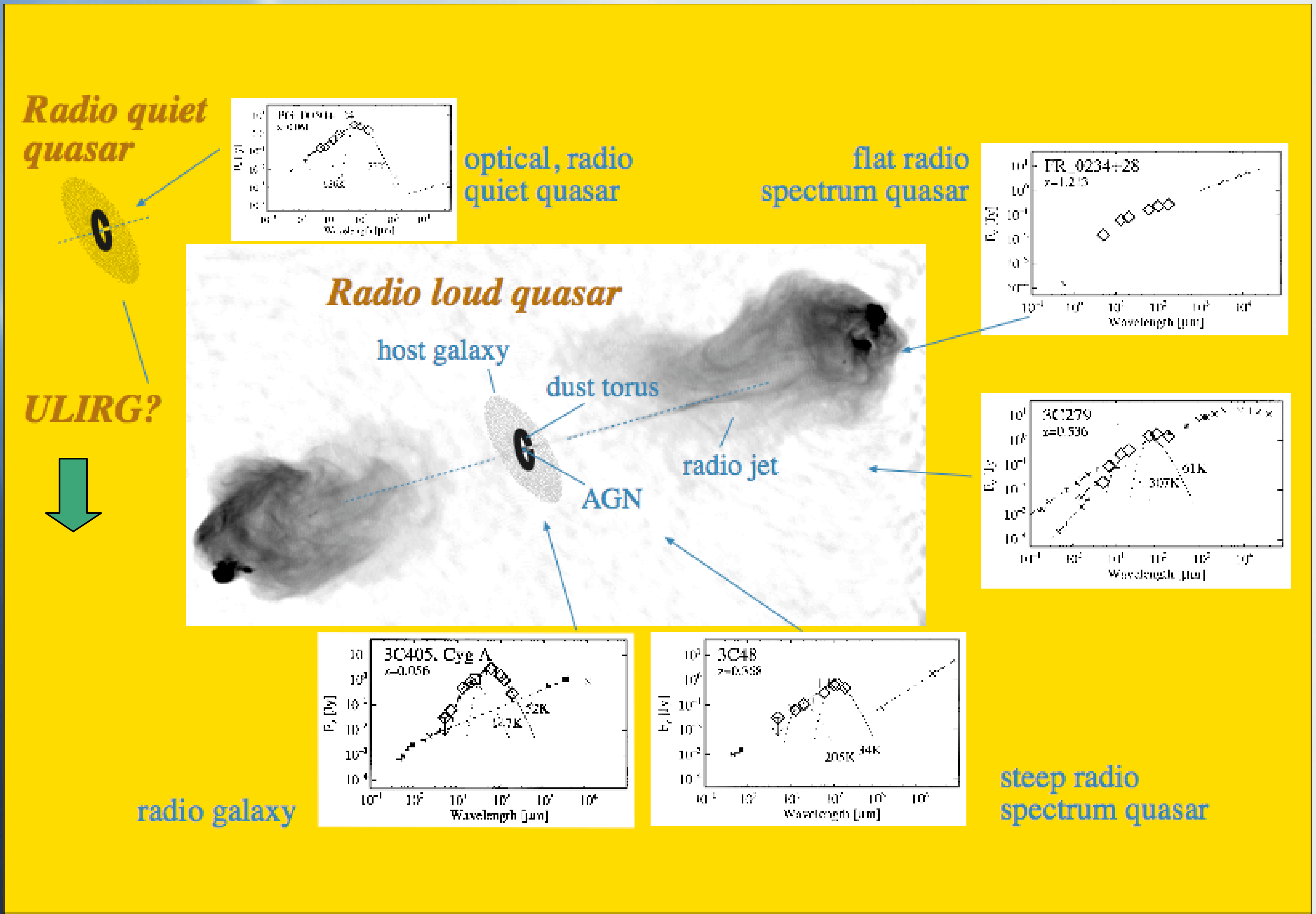
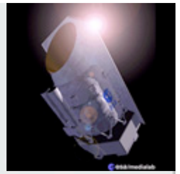
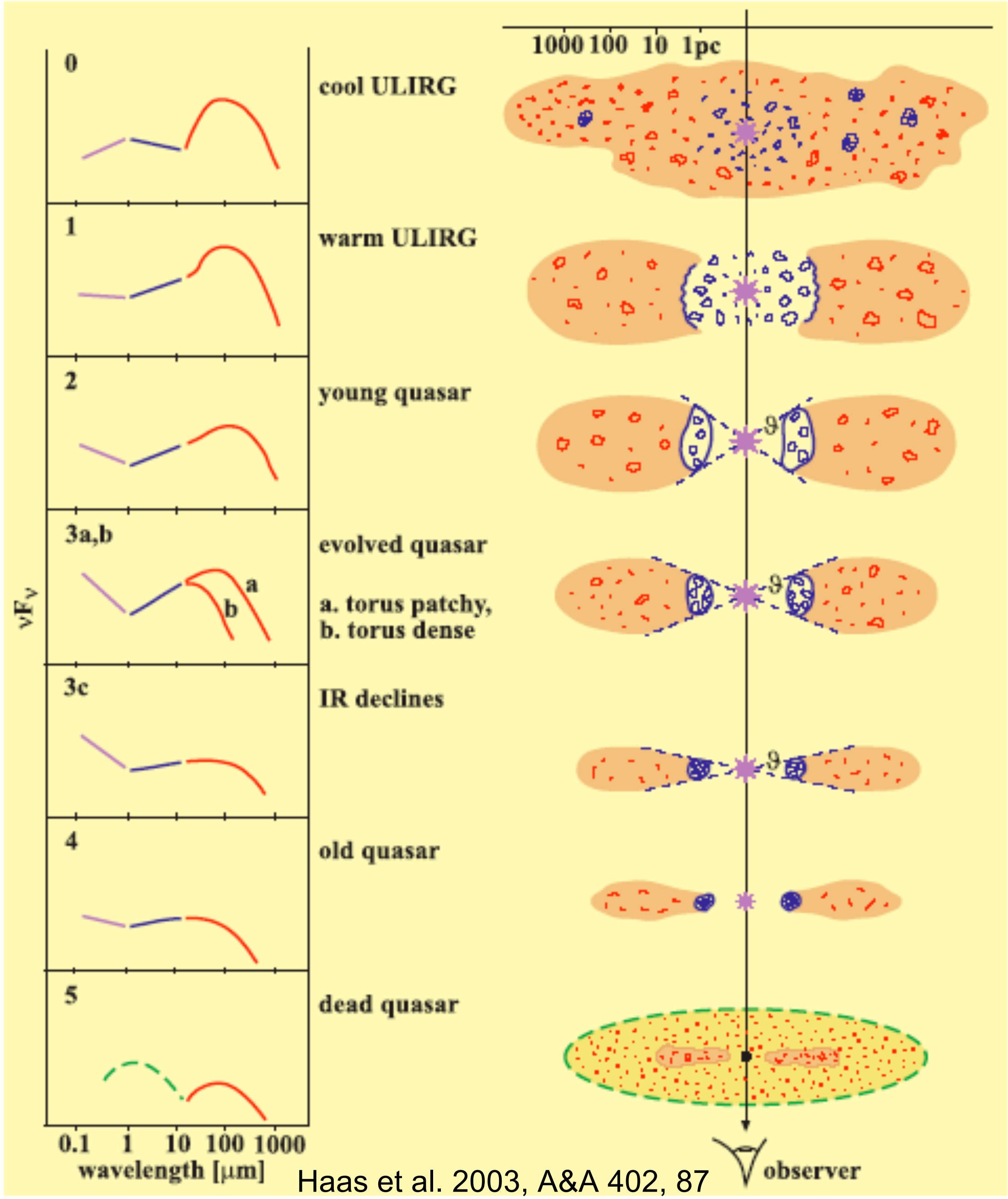


Illustration of the unified scheme of quasars complemented by its manifestation in the infrared SEDs of quasars (Haas et al., 1998).

ULIRG-QSO Evolution Scenarios

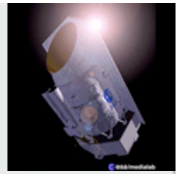




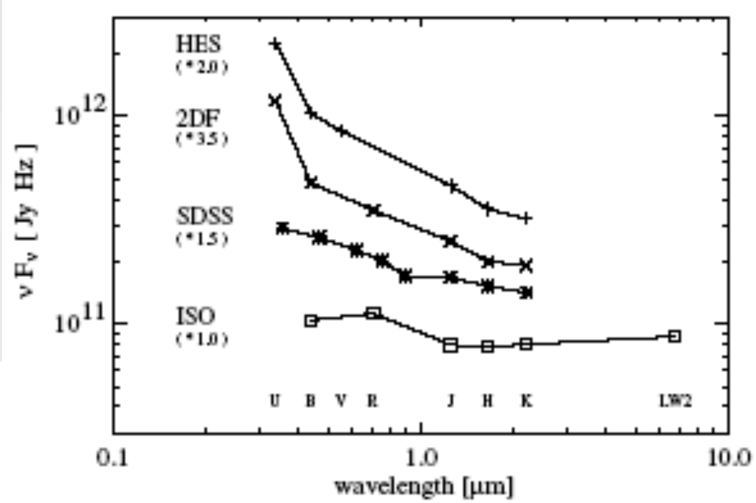
Haas et al. 2003, A&A 402, 87

- SED shapes are a function of dust distribution as well as power source
- Dissipative cloud collisions and angular momentum leads to organisation of clouds into a torus like configuration
- Initially starburst fuelled then powered more by the AGN until the BH becomes to starve
- PG QSOs optical slope independent of the IR properties (NIR-MIR slope) - face on

Quasars from the ISOCAM Parallel Survey at 6.7um



- Find quasars by their 'hot' nuclear dust emission
- Colour selection K-LW2 > 2.7 (Haas et al. 2004)
- Cross-correlation of 2MASS + CAMPAR survey
- Survey: 10 square degrees at |b|>20° (Siebenmorgen et al. 1996,2000, Ott et al. 2006)
- Sensitivity: F(LW2) ~ 1mJy --- >3000 point sources
- ~100 red sources - spec follow up to verify QSO nature



Leipski et al. 2005 A&A 440, L5

31% type-1
12% type-2
57% LINER/HII-type

Ott et al. 2003